Exemption No. 5595

UNITED STATES OF AMERICA
DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
RENTON, WASHINGTON 98055

In the matter of the petition of

SHANNON ENGINEERING, INC. Regulatory Docket No. 27048

for an exemption from § 25.841(a)
of the Federal Aviation Regulations

# DENIAL OF EXEMPTION

By letter dated October 28, 1992, Aubrey Mark Shannon of Shannon Engineering, Inc., Seattle, Washington, petitioned for exemption from § 25.841(a) of the Federal Aviation Regulations (FAR) to permit type certification of the Cessna Citation Model 500 with approval to operate at cabin altitudes up to 10,000 feet.

Section of the FAR affected:

> Section 25.841(a) requires that "Pressurized cabins and compartments to be occupied must be equipped to provide a cabin pressure altitude of not more than 8,000 feet at the maximum operating altitude of the airplane under normal operating conditions. If certification for operation over 25,000 feet is requested, the airplane must be able to maintain a cabin pressure altitude of not more than 15,000 feet in the event of any reasonably probable failure or malfunction in the pressurization system."

Related Section of the FAR:

> Section 23.841(a) requires that "If certification for operation over 31,000 feet is requested, the airplane must be able to maintain a cabin pressure altitude of not more than 15,000 feet in the event of any probable failure or malfunction in the pressurization system."

ANM-93-009-E

The petitioner's supportive information is as follows:

"Cessna is a general aircraft manufacturer of a variety of models. Two of these are the turbojet Citation 500 and 501. Cessna contends the only difference between the two models are their type certificates. Additionally, according to Reference A (*FAA Regulatory Docket No. 23771, Exemption #4050, dated June 27, 1984*) the FAA has repeated that "Cessna is correct in its contention that the Part 23 and the Part 25 aircraft are identical from an operational standpoint." The 500 is certified under FAR Part 25 and is required to maintain a cabin attitude of 8,000 feet by 25.841(a). The 501 is certified under FAR Part 23 and is allowed a cabin attitude (sic) of 15,000 feet under 23.841(a)."

"Sierra Industries Inc. is a modification center with a wide range of products. Four of these are STCs for the Cessna Citation 500, two of which are engine upgrades SA8176SW and SA8436SW. The last two are the longwing, STC SA2172NM, and the Eagle, STC SA645NW. Neither of these four STCs involve a change to the systems or degrade the slow speed handling qualities."

"SHANNON engineering seeks relief in the form of an exemption from FAR Part 25.841(a) through this petition. This is an effort to gain approval for the Cessna Citation 500-0001 through 500-0213 with stipulated restrictions to operate with a cabin altitude up to and including 10,000 feet, while certified under FAR Part 25. These aircraft will have either Sierra engine upgrade STC SA8176WS (sic) or STC SA8436SW. Each aircraft will also have one of the following: Sierra STC SA2172NM longwing, or STC SA645NW Eagle. We are convinced this does not compromise safety and will be in the public's interest."

"To illustrate that this exemption does not compromise safety, Cessna claims (Reference A) that from 1980 through 1986, "the Citation 501 have a lower unit accident and incident rate than their Part 25 counterpart." The 501 is allowed a cabin altitude of 15,000 feet, while the Part 25 aircraft (500) is restricted to 8,000 feet."

"In addition, this exemption would be in the public's interest. Allowing the Citation 500 to operate with a cabin altitude of 10,000 feet would lead to a higher cruising altitude through an AFM supplement. This would yield economic benefit to the operators by allowing these aircraft to remain economically competitive."

"The following hardware will be required for this exemption:

1. One of the following Sierra engine upgrade STCs, SA8176SW or SA8436SW.

2. One of the following Sierra STCs, SA2172NM or SA645NW.

3. Autopilot with approach coupling.

4. Flight director system.

5. Boom microphone.

6. Transponder ident. switch on pilot's control wheel."

A summary of the petitioner's October 28, 1992, request for exemption was published in the Federal Register on December 7, 1992 (57 FR 57856). Two comments were received.

One commenter notes that the Cessna Model 501 airplane was certificated under Part 23 of the FAR with a maximum altitude operating limit of 41,000 feet, with a cabin altitude of 8,000 feet and a maximum pressure differential of 8.8 pounds per square inch (psi). Later Model 500 airplanes (serial number 0214 and higher) are identical in this respect. Earlier Model 500 airplanes (s/n 0001 through 0213) were certificated with a maximum altitude operating limit of 35,000 feet with a pressure differential of 8.0 psi. The earlier airplanes can be approved for operation to a maximum altitude of 41,000 feet when modified in accordance with a Cessna service bulletin, which permits the higher pressure differential.

The same commenter also notes that the statement by the petitioner that the Model 501 is allowed a cabin altitude of 15,000 feet under § 23.841 is not correct. While not specifically required by the FAR, the Model 501 is certificated with a maximum cabin altitude of 8,000 feet, which is the maximum value allowed by Part 25. The commenter also notes the Model 500 and Model 501 both have excellent safety records; however, later Model 500 airplanes have maximum altitudes of 41,000 feet, which is identical to the Model 501, so the statement that the 501 has a better safety record than the 500 is misleading.

This commenter also disagrees that the proposed exemption is in the public interest, noting that the Part 25 requirement for a maximum cabin altitude of 8,000 feet has been included since Part 25 and its predecessor, Civil Air Regulations Part 4b, were promulgated. Unless studies are conducted to determine the effect of operation with higher cabin altitudes, there is no basis for increasing the maximum cabin altitude for the Model 500 airplanes.

The second commenter notes that the request for exemption leaves some important questions unanswered.

> "If operation at a cabin altitude of 10,000 feet is to be of short duration (less than one hour) there is little chance of a serious problem. Keeping in mind that 10,000 feet is considered to be the upper limit of efficient human performance, longer periods of time spent at this altitude, by the unacclimated individual, could result in a subtle deterioration of performance. Such performance detonation (sic) could lead to unrecognized errors in procedures, reaction time, and errors in communication which could have a negative outcome on the flights."
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> "The description of relief sought does not indicate the availability and use of oxygen equipment for the crew and passengers. Although the FAA does not recommend oxygen until at least 12,500 feet, it is important that oxygen be available for extended use at 10,000 feet for the pilots as a minimum."
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> "The concerns above are not meant as reason for disapproval, but concerns to be addressed in deciding how to implement the relief sought. The personnel flying the aircraft should receive physiological training to understand the potential problems of operating at 10,000 feet cabin altitude for extended periods. This will raise their awareness of the subtle nature of physiological changes at 10,000 feet, and the impact of Human Factors stresses on extended periods at this altitude."

The FAA's analysis/summary is as follows.

> The Cessna Model 500 airplane, serial numbers 0001 through 0213, are approved for operation at 35,000 feet with a cabin altitude operating limit of 8,000 feet. Model 500 airplanes with serial numbers 0214 and above are approved for operation at 41,000 feet, but retain the 8,000 feet as a cabin altitude operating limit. The Model 501 airplane is identical to the later Model 500 airplanes in that it is certificated to a maximum cabin altitude of 41,000 feet with a cabin altitude operating limit of 8,000 feet. A Cessna service bulletin is available for serial numbers 0001 through 0213 to allow operation to a maximum altitude of 41,000 feet, which results in a higher pressure differential (8.0 psi for the earlier serial number airplanes, 8.8 psi for the later airplanes and those earlier airplanes modified in accordance with the Cessna service bulletin). Based on availability of the service bulletin, the earlier Model 500 airplanes can be equipped for operation to 41,000 feet. Therefore, the statement made by the petitioner that issuance of this exemption is in the public interest because it would allow operation of the earlier Model 500 airplanes up to 41,000 feet is not substantiated; a service bulletin providing this capability already exists.
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> While § 23.841(a) and § 25.841(a) differ in that the Part 25 rule includes a cabin altitude of 8,000 feet and the Part 23 has no such requirement, both the Part 23 Model 501 and the Part 25 Model 500 are certificated with a pressurization control system which limits the cabin altitude to 8,000 feet. The statement that the Model 501 is allowed to operate with a cabin altitude up to 15,000 feet is in error; the airplane type design limits the cabin altitude to 8,000 feet, which is the same as for the Model 500 airplane.
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> The FAA has not previously certificated any transport category airplanes under Part 25 of the FAR for operation with cabin altitudes in excess of 8,000 feet, e.g. 10,000 feet. The history of safe operation of Part 25 airplanes, operating with a maximum cabin altitude of 8,000 feet, supports the premise that exposure to this altitude for prolonged periods of time does not result in degradation of flightcrew performance. The FAA has determined that an in-depth study of the effects of long term exposure to the higher cabin altitude would be necessary if approval to allow a higher cabin altitude were to be granted. Further, any new requirements for use of oxygen by the crew and passengers would need to be addressed.

In consideration of the foregoing, I find that a grant of exemption from the requirements of § 25.841(a) is not in the public interest. Therefore, pursuant to the authority contained in §§ 313(a) and 601(c) of the Federal Aviation Act of 1958, delegated to me by the Administrator (14 CFR 11.53), the petition of Shannon Engineering, Inc. to exempt them from compliance with § 25.841(a) of the Federal Aviation Regulations is denied.

Issued in Renton, Washington, on

Transport Airplane Directorate
Aircraft Certification Service

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